UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/070,908	05/04/98	SAKAMA M	0756-1755

IM61/0429

SIXBY FRIEDMAN LEEDOM & FERGUSON
2010 CORPORATE RIDGE
SUTIE 600
MCLEAN VA 22102

EXAMINER	
PADGETT,M	
ART UNIT	**PAPER NUMBER**
1761	6

DATE MAILED: 04/29/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
08/070,908	Mitsunori Sakama
Examiner	**Group Art Unit**
M. L. Padgett	1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 2/9/99 (2/5/99).

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 23-50 is/are pending in the application.

Of the above claim(s) 30 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 23-29 + 31-50 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: _____.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☒ Notice of References Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other _____

Office Action Summary

Part of Paper No. 6

*U.S. GPO: 1997-417-381/62710

Serial Number: 09/070,908

Art Unit: 1762

1. Claims 23-50 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 23, lines 9-10 "radio frequency energy" either needs an article showing its antecedent basis from line 3, or to be differentiated therefrom, as the present intent is vague and indefinite due to this ambiguity. In lines 12-13 "the stop..." is non-idiomatic English. Would replacing "stopped" in line 11 with --discontinued-- and deleting "the stop of... is continued during", then inserting --throughout-- therefore, provide applicant's intended meaning? Also, "the supply" (line 12 or 13) would be where the gas comes from (a noun), not the act from the first or third step. Maintaining consistent nomenclative, ie --the supplying-- is recommended. Analogous problems are also found in claims 24-30.

In claim 26, the meaning or intent of the last two lines is unclear, because they appear to be stating a condition that is inherent in the actions of the fourth step, ie as the film is only known to necessarily be composed of the silicon containing gas, "the discharge gas" could never make the only contributions to film formation, so these lines are verbose. Analogous problems are found in claim 27.

In claim 28 and 29 the body of the claim has no positive recitation of forming "a plurality of different films in a multilayer..." as required in the preamble.

In claim 30, last line "said silicon containing gas" lacks any antecedent basis, and makes it unclear whether applicant's really intend to be depositing a film comprising C or Si. As pages 11

and 31, provide support for forming a "hard carbon film" or DLC, it is probable applicant's did intend "a film comprising carbon", hence see following sections on New Matter and species selection.

Claims 48-50 are vague and indefinite because the time "t" is effectively undefined, since: (1) "uneven" can mean --odd-- or variable, etc., so that meaning is ambiguous, although the examiner assumes that the latter meaning was intended as its more logical; (2) there is absolutely NO indication what these "uneven values" as based on, ie the "largest period of time" necessary for what to happen? As written these claims are essentially meaningless, although the examiner assumes that they are intended to be based on the concept discussed on p. 8-9, etc in the specification, but this has not been claimed.

2. Claims 23-50 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant's claims are replete with new matter, and virtually no attempt was made by applicant's to show support from their specification. No support for either "amorphous film comprising silicon" or "a film comprising carbon" was found. There are statements such as p.1, line 5 directed to generic thin film deposition, however no silicon or carbon films that may contain significant other constituents, ie are "comprising" Si or C, were found. Reference to amorphous silicon films is found throughout the specification, with page 7 also mentioning microcrystalline Si

which is open language.

or crystalline silicon, but no support for "... comprising...". Page 31 and 11 mentioned above, support "hard carbon" and DLC, but no films that are "comprising carbon", so these are New Matter. Note that "hard" is relative and not defined therein.

Furthermore, no "silicon containing gas" nor "carbon containing gas" is supported by the specification, so are also new matter. As previously discussed, the misnomer "silicide gas" can be given no accurate meaning in the context of the disclosure, except that applicant relates it to silane (SiH_4) and disilane (pages 8, 11, etc). On page 11, use of methane gas for the carbon deposits is disclosed, but not the broader limitation of claim 30.

In NONE of the claims do applicant's require the film deposition to be caused by plasma or RF discharge, as use of RF energy does NOT necessitate that any discharge actually takes place, since radio frequency energy may be used to power heaters, etc. The specification specifically, from the first sentence to the end requires that the claimed deposition be via RF plasma discharge, hence this broadening of scope is also NEW Matter.

3. Newly submitted claim 30 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: carbon deposition is a different species of film deposition from silicon deposits, involving different chemistry than silicon film deposition, and has not been searched or considered in the previous action. Hard carbon films disclosed by applicant's specification are a distinctly different species than any of the disclosed Si films

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the

merits. Accordingly, claim 30 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

4. The disclosure is objected to because of the following informalities: Proof reading of the specification is needed, in particular use of "decompressed" or "decompression chamber" and "silicide gas", used throughout the specification need to be corrected, in light of the comments in the previous actions rejections. Clear support for changes should be provided.

Appropriate correction is required.

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 23, 25-29, 45, 47, 48 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. Kozuka teaches deposition of multiple layer non-monocrystalline semiconductor devices, exemplified by deposition of amorphous silicon TFT (thin film transistors), by forming successive layers in a manner such that a plasma atmosphere is constantly maintained from the start until the end of the film formation process, in order to protect the interfaces from damage by initial stages of plasma formation and from contamination (Abstract), as typically found in discontinuous plasma processes (col. 2, line 57- col. 3, line 7). In col. 4, lines 38-49, Kozuka particularly teach that "since the plasma is continuously generated, the start and end of film formation can be achieved by changing the raw material gas. During film formation,

therefore, the raw material gas is preferably used not singly but as a mixture with a diluting gas. With the use of such mixed gas, when the supply of the raw material gas is terminated after the completion of film formation, the discharge is maintained by the diluting gas so that the fluctuation in plasma can be suppressed. The diluting gas can be hydrogen, argon or helium...." . Embodiments 2 (col. 6, line 55- col. 9, line 12) and 3 (col 9, line 15- col 10, line 22), form plasma deposited amorphous Si TFT films using silane gas and H_2 as a dilutant, with the first deposition being a plasma deposited Si_3N_4 insulating film, followed by films that read on claimed deposits. Reactant gas (SiH_4) flow is stopped in each plasma chamber and the dilutant gas plasma continues in that chamber before transfer to the next chamber, where the dilutant gas plasma is present before reactive gas starts to flow into the chamber.

Kozuka differs from applicant's claims by using H_2 dilutant gas during both deposition and non-deposition plasmas in their examples, and by stating a preference for the dilutant gas (H_2 or Ar or He) to be mixed with the reactant gas, while applicant's only use hydrogen gas or "discharge gas" (equivalent to Kozuka's dilutant gas) during their non-deposition plasma, either before or after the amorphous silicon containing deposition. From col 4, line 50-62, it appears that the main reason the dilutant gas is used with the reactant gas is so that only one gas flow needs to be changed and thus avoid problems if ones flow control equipment has slow responses, however, as is seen by the teachings of Gupta et al (Abstract; col 2, lines 50-54; col. 3, lines 16-38; col. 5, lines 30-50; col. 6, line 61- col. 7, lines 20 and 35-40; and claims 9-11, especially col. 5, line 39 to 42) that for an inert plasma gas, such as Ar, used for pre- or post-processing

(deposition) plasma that prevents particle contamination of the substrate, that the inert gas maybe stop simultaneous with start of the reactant gas, such that constant plasma is maintained and particle contamination prevented. Given the teachings of Gupta et al, which are taught to be generally applicable to plasma processes, including depositions and processes exemplified by using silicon containing gases such as TEOS, it would have been obvious to one of ordinary skill in the art, that the dilutant gas of Kozuka (H_2 or Ar or He) need not have been mixed with the reactant gas because it is not needed for the chemical reaction involved in the deposition, and Gupta et al shows that it is possible to achieve the objective of Kozuka (preventing contamination and achieving a full plasma before introducing reactant gas, ie equivalent to no plasma on/off hysteresis) via switching from inert gas to reactant gas, instead of maintaining the inert or dilutant gas flow throughout the sequence. Obviously, if ones equipment has poor gas flow ~~thinning~~ timing control, one would not use the modification from Gupta et al, but where sufficient regulation abilities exist, one would have been further motivated by saving resources from wasteful or un-need use.

The timings for length of non-coating plasmas will depend on mechanical and electrical abilities of the systems, and determined by routine experimentation by the competent practitioner. Note Kozuka discusses TFT devices in general and the presence of a gate electrode on the substrate before deposition of Si_3N_4 and α-Si layers on col. 7, lines 45-55.

7. Claims 24, 46 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al alone as applied above, or further in view of Mei or Kaschmitter et al or Yamuzaki et al.

Kozuka teaches initial plasma deposition of an insulating layer of silicon nitride in embodiments 2 and 3 as mentioned above, and generally discusses the importance of the interface between amorphous Si and the insulating film (col 3, lines 8-28), but does not specifically discuss silicon oxide as the insulating film, however as SiO_2 and Si_3N_4 are conventionally used as alternative dielectrics in semiconductor devices, it would have been obvious to one of ordinary skill in the art to substitute one for the other in the teachings of Kozuka.

Alternately, any of the optional tertiary references show the use of silicon oxide layers as claimed. In Kaschmitter et al, see claims 20, 22 and 24; col 4, line 49- col. 5, line 10 and col 7, lines 25-27. In Yamuzaki et al, see Abstract, col 20, lines 15-49, especially 35-39 where silicon oxide and silicon nitride are taught to be equivalently used, and claims 1, 5, 7, 9 and 14. In Mei et al, see Abstract; col. 1, lines 44-49; col. 2, lines 33-66, especially lines 58-60; col. 3, lines 1-6, where SiO_2 is seen to be used before α-Si deposits in TFT device manufacture. Hence use of silicon oxides as claimed, would have been an obvious alternative to Kozuka's taught silicon nitride as it has been shown to be a known equivalent alternative thereto in analogous processes and structures.

8. Claims 31-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al as applied to claims 23-39, and 45-50 above, and further in view of Mei et al or Kaschmitter et al or Yamuzaki et al.

These claims differ from the combination to Kozuka and Gupta et al in requiring that the amorphous Si containing film be crystallized using laser light, however the references of Mei et al, Kaschmitter et al and Yamuzaki et al already introduced above, show that it is old and well known to use lasers to induce crystallization in α-Si layers in TFT structures (Abstracts, previously cited sections, plus), hence it would have been obvious to one of ordinary skill in the art to further treat the structures produced in Kozuka (as combined with Gupta et al) as shown in any of these ternary references, because these conventional laser annealing technique are shown to be desirable for TFT devices.

9. Czubatyj et al is cited as equivalent to Mei et al, Kaschmitter et al and Yamuzaki et al for laser crystallization of α-Si in TFT devices, and for teachings of interest on the alternative use of SiO_2 or Si_3N_4 deposited by PECVD for gate insulators used in those devices.

10. Applicant's arguments with respect to claims 23-50 have been considered but are moot in view of the new ground(s) of rejection.

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication should be directed to M.L. Padgett at telephone number (703) 308-2336 and FAX# (703) 305-3599 (after final-official) and 305-6357 (unofficial).

Padgett/mm

April 26, 1999

MARIANNE PADGETT
PRIMARY EXAMINER
GROUP ~~1100~~ 1700